

What is claimed is:

- 1     1.     A CMP retaining ring, comprising:
  - 2                     an inner peripheral surface;
  - 3                     an outer peripheral surface;
  - 4                     a lower surface adapted to contact and depress an upper surface of a
  - 5     polishing pad during chemical mechanical polishing of a lower surface of a substrate;
  - 6                     at least a groove on said lower surface of said retaining ring; and said
  - 7     groove extending from a position at or adjacent said inner peripheral surface of said
  - 8     retaining ring, to a position at or adjacent said outer peripheral surface of said retaining
  - 9     ring;
  - 10                    at least a portion of said groove has a rounded contour or slanted
  - 11     contour.
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- 13     2.     The CMP retaining ring of claim 1 wherein said groove has a semicircle profile.
- 14     3.     The CMP retaining ring of claim 1 wherein said groove has a semicircle profile
- 15     and said groove has a rounded top corner adjacent to the lower surface of the retaining
- 16     ring.

- 17 4. The CMP retaining ring of claim 1 wherein said groove has a semicircle profile  
18 with a radius between 2 and 15 mm.
- 19 5. The CMP retaining ring of claim 1 wherein said groove has at least one rounded  
20 corner.
- 21 6. The CMP retaining ring of claim 1 wherein said groove has rounded corners  
22 adjacent to the bottom of said grooves.
- 23 7. The CMP retaining ring of claim 1 wherein said groove has rounded top corners  
24 adjacent to the lower surface of said retaining ring.
- 25 8. The CMP retaining ring of claim 1 wherein the cross-sectional area of said groove  
26 changes along the length of said groove.
- 27 9. The CMP retaining ring of claim 1 wherein said groove has a width between 1 mm  
28 and 30 mm; said groove has a depth between 1 and 15 mm.
- 29 10. The CMP retaining ring of claim 1 wherein said groove has vertical sidewalls or  
30 sloped sidewalls.
- 31 11. The CMP retaining ring of claim 1 wherein said groove has vertical sidewalls and  
32 an about horizontal bottom and at least one rounded corner between said vertical  
33 sidewalls and said horizontal bottom.
- 34 12. The CMP retaining ring of claim 1 wherein said groove has straight sidewalls and  
35 top and bottom corners; at least one of said corners is rounded or curvilinear.

36 13. The CMP retaining ring of claim 1 wherein said retaining ring can further comprise  
37 other channels; the lower surface of the retaining ring can further comprise a plurality of  
38 protrusions and recesses or a mixture of both.

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40 14. A process for chemical-mechanical polishing a substrate comprising:  
41 said substrate is disposed within a polishing head facing a polishing  
42 table; said substrate is retained within the polishing head by a retainer ring, and  
43 at least a portion of said groove has a rounded contour;  
44 supplying a slurry to said polishing table or to said polish head;  
45 moving the polishing table and/or the polishing head to chemically  
46 polish the wafer.

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48 15. The process of claim 14 which further includes: said substrate is a wafer; forming  
49 a deposition layer on the surface of said wafer and chemical mechanically polishing  
50 said deposition layer.

51 16. The process of claim 14 wherein said groove has a semicircle profile.

52 17. The process of claim 14 wherein said groove has a semicircle profile and said  
53 groove has a rounded corner adjacent to the lower surface of the retaining ring.

54 18. The process of claim 14 wherein said groove has at least one rounded corner.

55 19. The process of claim 14 wherein said grooves has at least one rounded bottom  
56 corner.

57 20. The process of claim 14 wherein said groove has rounded edges adjacent to the  
58 bottom of said grooves.

59 21. The process of claim 14 wherein said groove has rounded top edges adjacent to  
60 the lower surface of said retaining ring.

61 22. The process of claim 14 wherein said groove has a width between 1 and 30 mm;  
62 said groove has a depth between 1 and 15 mm.

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